

**APPLICATION OF  
INTEGRATED AIR/ENERGY  
MEASURES IN LOCAL AIR  
POLLUTION CONTROL**

**RENEWABLES HAVE  
EXTREMELY LOW  
EMISSION PROFILES  
(BIOMASS AND  
GEOTHERMAL HAVE  
SOME SMALL IMPACTS)**

**SIZE OF BENEFITS  
DEPENDS ON TYPE OF  
GENERATION DISPLACED.  
LARGEST BENEFITS COME  
FROM REPLACING COAL-  
FIRED GENERATION**

# Background

- Harmonized strategies for reducing GHGs and criteria pollutants
- Fossil fuel combustion is a major source of CO<sub>2</sub> as well as PM, NO<sub>x</sub>, SO<sub>2</sub>, and CO
- Strong relationship with Ozone

# Objectives

- Reduce GHGs without impeding progress towards other clean air goals
- Capitalize on opportunities for co-control benefits to achieve GHG and air pollution benefits with economic efficiency
- Highlight technology and policy options

# Outline

- Sectors
  - Fossil-Fueled Power Generation
  - Renewable Power Generation
  - Transportation
  - Energy-Intensive Industries
  - Residential/Commercial Buildings
  - Municipal Solid Waste
  - Agriculture and Forestry
  - Carbon Sequestration
- Market-Based Mechanisms
- Harmonized Strategy Case Studies
- Conclusions and Next Steps

# **Why Does a Multi-Pollutant Strategy Make Sense?**

- Increased Environmental Protection
- More Expeditious Attainment
- Regulatory Certainty for Utilities
- Increased Efficiencies

# **STAPPA/ALAPCO Menu of Options for Multi-Pollutant Strategies**

 Analyzed Every Economic Sector

 Utilities

 Res/Com

 Transportation

 Waste

 Industrial

 Agriculture

 Reviewed Market Mechanisms

 Modeled Case Studies in Four Areas



# Electric Industry Criteria Pollutant Emissions, 1997

Pollutant	Electric Utility Emissions (Short Tons)	Portion of Total U.S. Emissions
SO <sub>2</sub>	12,632,000	64%
NO <sub>x</sub>	6,178,000	26%
PM <sub>10</sub>	290,000	<1%
VOC	51,000	<1%
Lead	64,000	2%
CO	406,000	<1%

# Electric Utility GHG Emissions, 1997

Greenhouse Gas	Electric Utility Emissions (MMTCE)	Portion of Total U.S. Emissions
CO <sub>2</sub>	532.3	37%
Methane	0.1	<1%
Nitrous Oxides	2.3	2%

# **Power Generation Policy Options**

- Comparable Emission Standards
- Output-Based Emission Standards
- Tax Credits and Subsidies
- Environmental Disclosure
- Emissions Portfolio Standards
- Renewable Portfolio Standards
- Emissions Trading

# Renewable Power Technology Options

- Hydropower
- Biomass Combustion
- Geothermal Systems
- Wind Turbines
- Photovoltaics
- Solar Thermal

# Renewable Power Strategies: Costs and Emissions Reductions

Technology	Capital Cost (\$/kW)	Total Costs (\$/kWh)	Cost of CO <sub>2</sub> Reductions (\$/ton)	Percent CO <sub>2</sub> Reduction	Percent SO <sub>2</sub> Reduction	Percent NO <sub>x</sub> Reduction
Wind	950-1,100	0.039 – 0.07	8-47	100	100	100
PV (High Volume)	4,500	0.21	153-166	100	100	100
Solar Thermal (Parabolic Trough)	2,700	0.10-0.13	60-98	100	100	100
Biomass	1,900-2,100	0.05-0.095	18-64	100	98-100	83-99
Landfill Gas (Fuel Cell)	5,000	0.07-0.10	0.01-0.02	4,090	>99	>99
Geothermal (Flash Stream)	1,400	0.05-0.08	18-58	96	97	100
Hydro at a New Site	1,700-2,300	0.055-0.07	21-47	100	100	100
Hydro at an Existing Dam	900-1,100	0.033-0.037	3-19	100 <sup>b</sup>	100	100

# **Renewable Power Policy Options**

- Tax Credits
- Systems Benefit Charges
- Air Permitting Exemptions
- Green Pricing Programs
- Renewable Portfolio Standards
- Environmental Disclosure
- Output-Based Emission Standards

# Evaluation of Harmonized Control Strategies

- Developed “What-If” Scenarios For Four Areas:
  - Atlanta, GA
  - Louisville, KY
  - New Hampshire
  - Ventura, CA
- Areas Selected Power Generation, Transportation Industrial and Commercial Measures to Reduce CO<sub>2</sub> and other Air Pollutants

# Harmonized Strategy Summary for the Four Case Study Areas

	Level of Penetration Modeling for Each Area			
Harmonized Strategies by Sector	New Hampshire	Atlanta, GA	Louisville, KY	Ventura County, CA
<b>Electric Generation</b>				
Gas-fired generation converted to gas combined-cycle	0%	0%	0%	100%
Fuel switch from oil or coal to natural gas	25%	20%	0%	0%
Coal-fired capacity displaced by natural gas combined-cycle capacity	50%	30%	25%	0%
Fossil-fuel generation displaced by renewables	1%	1%	1%	1%
Fossil-fuel generation displaced by fuel cells	1%	1%	1%	1%



# New Hampshire

## Emission Reductions from Modeled Harmonized Strategies (tpy)

Harmonized Strategy	SO <sub>2</sub>	NO <sub>x</sub>	PM	VOC	CO	CO <sub>2</sub>
Oil-fired electric generation to natural gas (25%)	2,132	161	25	0	0	118,396
Coal-fired generation displaced by natural gas combined-cycle (50%)	19,220	7,430	873	0	0	1,145,015
Renewables penetration (1%)	256	85	10	1	5	33,660
Fuel cell penetration (1%)	256	85	10	1	5	22,625
Electricity consumption DSM (5% Commercial/Residential)	1,255	418	48	6	25	165,484
Electricity consumption DSM (2% Industrial)	166	55	6	1	3	21,844
<b>Total Electric Generation Emission Reductions</b>	<b>23,285</b>	<b>8,234</b>	<b>972</b>	<b>9</b>	<b>38</b>	<b>1,507,024</b>
<b>% Reduction</b>	<b>49%</b>	<b>46%</b>	<b>48%</b>	<b>8%</b>	<b>2%</b>	<b>31%</b>

# Atlanta, GA

## Emission Reductions from Modeled Harmonized Strategies (tpy)

Harmonized Strategy	SO <sub>2</sub>	NO <sub>x</sub>	PM	VOC	CO	CO <sub>2</sub>
Oil/coal generation to natural gas ( up to 20%)	8,528	2,005	39	0	0	702,181
Coal displaced by natural gas combined-cycle (30%)	12,792	3,686	62	0	0	1,245,457
Renewables penetration (1%)	215	72	5	1	8	37,035
Fuel cell penetration (1%)	215	72	5	1	8	20,706
Electricity consumption DSM (5% Commercial/Residential)	694	233	17	3	25	120,310
Electricity consumption DSM (2% Industrial)	139	47	3	1	5	24,062
Total Electric Generation Emission Reductions	22,582	6,114	133	6	46	2,149,750
% Reduction	53%	47%	21%	5%	6%	38%

# Louisville, KY

## Emission Reductions from Modeled Harmonized Strategies (tpy)

Harmonized Strategy	SO <sub>2</sub>	NO <sub>x</sub>	PM	VOC	CO	CO <sub>2</sub>
Coal-fired generation displaced by natural gas combined-cycle (25%)	15,054	7,276	65	0	0	2,911,701
Renewables penetration (1%)	452	227	3	2	14	136,189
Fuel cell penetration (1%)	452	227	3	2	14	105,769
Electricity consumption DSM (5% Commercial/Residential)	1,461	733	10	5	45	441,440
Electricity consumption DSM (2% Industrial)	292	147	2	1	9	88,288
<b>Total Electric Generation Emission Reductions</b>	<b>17,710</b>	<b>8,609</b>	<b>83</b>	<b>10</b>	<b>81</b>	<b>3,683,388</b>
<b>% Reduction</b>	<b>29%</b>	<b>29%</b>	<b>23%</b>	<b>6%</b>	<b>6%</b>	<b>22%</b>

# Ventura County, CA

## Emission Reductions from Modeled Harmonized Strategies (tpy)

Harmonized Strategy	SO <sub>2</sub>	NO <sub>x</sub>	PM	VOC	CO	CO <sub>2</sub>
Gas-fired generation to combined-cycle (100%)	0	0	0	0	0	532,874
Renewables penetration (1%)	0	4	.5	0	8	9,981
Fuel cell penetration (1%)	0	4	.5	0	8	3,310
Electricity consumption DSM (5% Commercial/Residential)	0	12	1	0	27	32,498
Electricity consumption DSM (2% Industrial)	0	2	0	0	5	6,500
<b>Total Electric Generation Emission Reductions</b>	0	22	2	0	49	585,163
<b>% Reduction</b>	0%	6%	5%	0%	6%	38%

# Percent Reduction from Baseline Emissions in Each Case Study Area

Area	SO <sub>2</sub>	NO <sub>x</sub>	PM	VOC	CO	CO <sub>2</sub>
New Hampshire	41%	17%	12%	3%	4%	12%
Atlanta, GA	40%	6%	1%	3%	4%	7%
Louisville, KY	26%	14%	3%	3%	4%	15%
Ventura County, CA	2%	4%	1%	4%	4%	11%

# Conclusions

- Tremendous Opportunities Exist for Co-Controlling GHGs and Other Air Pollutants
- Harmonized Strategies Are Available In Every Sector of the Economy
- Strategies Can Achieve Significant Reductions in GHGs and Conventional Pollutants
- Harmonized Strategies Can Be Tailored Based On the Needs and Circumstances of Individual Areas

# Next Steps

- Final STAPPA/ALAPCO Report on Harmonized Strategies Widely Distributed and Discussed
- STAPPA/ALAPCO Currently Developing User-Friendly Planning Software Tool That Will Enable Users to Easily Assess the Benefits Available from Applying Harmonized Strategies
- Software Tool Targeted for Completion in early 2002

REGULATORS CAN PLAY A  
MEANINGFUL ROLE IN THE  
DEVELOPMENT OF RE THROUGH  
POLICIES AND PROGRAMS UNDER  
OUR JURISDICTION AND  
THROUGH WORK WITH OUR  
COUNTERPARTS IN OTHER  
AGENCIES-STATE ENERGY  
OFFICES AND UTILITY  
COMMISSIONS



STATE LOCAL AIR AGENCY  
ACTIONS  
MAKE RE PRIORITY  
BUILD INTERNAL CAPACITY  
BUILD RELATIONSHIPS  
WITH OTHER AGENCIES  
EVALUATE AREA FOR RE  
POSSIBILITIES  
BUILD STAKEHOLDER  
SUPPORT

# OTHER AIR AGENCY ROLES

- MARKET MAKER-FLEET  
PURCHASES
- BUILDING EFFICIENCY
- PROCUREMENT LEVERAGE

# SOME LOUISVILLE APCD ENERGY INITIATIVES

FERC-HYDROELECTRIC

DSM INTERVENTION

ICLEI URBAN HEAT ISLAND

LAWN CARE FOR CLEANER AIR

CH&P PROJECT

LAND USE INITIATIVES-TREE COVER,  
INFILL, MULTI-MODAL REQUIREMENT

# APCD ENERGY INITIATIVES

- GREEN BUILDING DESIGN CHARETTE
- ICLEI CITIES FOR CLIMATE PROTECTION
- USDOE/KYDOE INDUSTRIAL ENERGY AUDIT
- EE/EC PUBLIC WORKSHOPS

# APCD INTEGRATED APPROACH

- DEVELOP INTEGRATED TEAM-LAND USE, TRANSPORTATION, E2, P2, SUSTAINABLE DEVELOPMENT TO WORK WITH ENGINEERING STAFF AND REGULATED BUSINESSES